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Economic and Policy Determinants of Public Sector Deficits

Jorge Marshall
and
Klaus Schmidt-Hebbel

A framework for determining how much the most important economic and policy variables contribute to the public sector deficit — and for comparing the direct effects of economic shocks with those arising from policy-controlled variables.

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Marshall and Schmidt-Hebbel have developed a framework for determining how much the most important economic and policy variables contribute to the public sector deficit.

Their method involves behavioral relations, identities for some key macroeconomic and sector variables, and an accounting breakdown of the consolidated public sector deficit.

This allows one to compare the direct effects of various foreign and domestic economic shocks on the deficit with those arising from changes in policy-controlled variables.

The method is useful for decomposing historical time series of public deficits according to their main determinants — and for carrying out simulation or projection exercises for the level and structure of future deficits.

This paper is a product of the Macroeconomic Adjustment and Growth Division, Country Economics Department. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Susheela Jonnakuty, room N11-041, extension 61769 (54 pages with tables).

Economic and Policy Determinants of Public Sector Deficits*

by

Jorge Marshall**
and
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Table of Contents

I.	Introduction	3
II.	An Accounting Framework for Public Sector Analysis	7
	II.1. Sources and Uses of Funds of the Public Sector	7
	II.2. The Consolidated Deficit of the Public Sector	17
III.	Economic and Policy Determinants of Public Sector Deficits	19
	III.1. Accounting Decomposition of the Deficit	19
	III.2. Determinants of Public Deficits	23
IV.	Final Remarks	34
References		35
Appendix 1.	Definitions and Identities	36
Appendix 2.	Economy-wide Accounting Consistency	40
Appendix 3.	Balance Sheets of the Public and Private Sectors	47
Appendix 4	Economic and Policy Determinants of the Public Debt Output Ratio	49

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I. INTRODUCTION

Public sector deficits have shown significant variations in their levels and structures in most developing countries during the last 15 years. This has been the result of both policy shifts planned by policy makers and shocks in international and domestic variables, not under direct control of policy makers. Foreign shocks and domestic swings have been particularly intense since the seventies. Public deficits have often reflected these changes immediately, while policy reactions to them have tended to be slower, probably because of both political-institutional constraints and uncertainty on how transitory these shocks were.

Particularly severe were foreign shocks related to commodity prices and international interest rates. On the financing side the foreign credit constraint imposed in the aftermath of the foreign debt crisis forced a mix of fiscal adjustment and substitution of domestic financing for external borrowing, combination which varied widely between different developing countries.[1] Domestic recessions, induced in part by adverse foreign shocks, contributed to public deficits by eroding tax bases and revenues of public enterprises. The lack of fiscal adjustment often worsened the situation, when domestic financing of the deficits led to higher inflation and real interest rates, which

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[1] For a discussion of the fiscal dimension of commodity export cycles and adjustment to the foreign debt crisis, see World Bank (1988), chap. 3.

contributed to even higher primary deficits.[2]

The purpose of this paper is to derive a framework for quantifying the contribution of the most important economic and policy variables to the public sector deficit. In particular, this paper distinguishes the effects of various foreign and domestic economic variables on the deficit from those stemming from policy-controlled variables. Combining an accounting decomposition of the consolidated public sector deficit with various behavioral relations and identities for some key macroeconomic variables, the framework quantifies the direct impact of the most important economic and policy variables on the deficit. This methodology is useful for decomposing historical time series of public deficits according to their main determinants and for carrying out simulation or projection exercises for the level and structure of future deficits.[3]

Because the budget deficit, its composition and its financing interact with domestic macroeconomic variables, it is important to note that this paper focuses only on the one-way causality from economic variables to the deficit. For the simultaneous interaction between the public sector budget constraints and goods and asset markets, one should refer to macroeconomic models which include equilibrium (or disequilibrium) conditions for those markets, in addition to the public sector budget restriction.

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[2] The contribution of higher inflation to the inflation-adjusted or primary public deficit is due to the Oliveira-Tanzi effect on tax revenues or, in general, on public sector net income.

[3] The methodology presented here will be applied by the country studies of the World Bank research proposal on Macroeconomics of Public Sector Deficits (see Easterly, Rodriguez, and Schmidt-Hebbel, 1989). An application to Colombia and Venezuela is already presented in Schmidt-Hebbel and Webb (1989).

The model developed here is related to other decomposition or simulation studies for the public sector deficit (such as the applications for Brazil by Oliveira (1985) and Werneck (1987), and is based on a significant degree on Marshall and Schmidt-Hebbel (1988). It is also related to recent work on economy-wide macroeconomic consistency (see, in particular, Easterly (1989), Holsen (1989), and Khadr and Schmidt-Hebbel (1989a, 1989b)), presenting mutually consistent flow constraints for the public, private, and external sectors.

The derived measure for the consolidated public sector deficit is consistent with the most comprehensive concept of the public sector, encompassing general government, public enterprises, the central bank, and other financial institutions. The budget structure of each of these sectors follows closely the format of the IMF Public Finance Statistics Yearbook. The deficit concept used throughout the paper is the nominal consolidated public sector deficit or public sector borrowing requirement.[4]

Section II presents an accounting framework for the public sector. Budget restrictions for the four above mentioned sub-sectors are combined to obtain an equation for the consolidated public sector deficit. Appendix 2 shows economy-wide consistency between the public sector accounts and those of the private and foreign sectors.

Section III introduces various behavioral functions, arbitrage conditions, and identities (some of them following Buiter (1988)), and combines them with the public deficit expression of section II, in order to quantify the

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[4] Simple transformations of the equations derived in the paper would allow to obtain measures which correspond to the primary deficit, for instance. For a discussion of the differences between nominal, pricing and operational deficits see World Bank (1988), chap. 3, and for empirical comparisons of alternative deficit concepts for Brazil and Mexico see Schmidt-Hebbel and Webb (1989).

contribution of the most important economic and policy variables to the deficit. The final derived expression allows to distinguish the effects of foreign and domestic economic shocks from the changes induced by the policy makers.

An alternative expression to this, which is based on flow budget constraints, quantifies the effects of economic and policy variables on net public debt. This alternative measure, which considers capital gains and losses from inflation and exchange rate depreciation (as considered by Buiter (1988) and Khadr and Schmidt-Hebbel (1989a, b)) is developed in appendix 4. Section IV concludes.

II. AN ACCOUNTING FRAMEWORK FOR PUBLIC SECTOR ANALYSIS

This section presents an accounting framework for the public sector, which will allow to derive the consolidated public sector deficit and to decompose it according to its main determinants in section III. Budgetary identities of four public sub-sectors, ordered by sources and uses of funds, are introduced in III.1. This allows to obtain an expression for the consolidated public sector deficit in III.2. Consistency between the public sector accounts and those of the private and foreign sectors is explicitly treated in appendix 2.

II.1. Sources and Uses of Funds of the Public Sector

Public sector accounting in this section is based on flow budget constraints for four public sub-sectors, consistent with well-known sources and uses of funds tables for each sub-sector. The four subsectors considered here are: public sector, general government (which comprises central and local governments, the public social security system, and the decentralized agencies), the consolidated public enterprise sector, the central bank, and other public financial institutions. The central government is explicitly assumed to own the equity of the remaining public subsectors.

Regarding the public enterprise sector, it is convenient to classify the enterprises according to their activity. The proposed classification identifies four different categories of public enterprises: producers of exportable, importable, and non-tradable goods and producers of public services. These

groups are referred to by subscripts X, M, N and S, respectively[5].

A useful feature of this disaggregation is that it allows to measure the impact of relevant relative price changes (terms of trade, real exchange rate, and prices of public services) and to quantify the effect of changes in the sectoral output composition on the consolidated budget.

Next, the identities between sources and uses of funds are introduced for each public sector. Expenditure, revenue, and financing items are expressed in current-price domestic currency units. Notation and variable definitions are introduced in Appendix 1.

General Government (G)

The identity between sources and uses of funds for the general government is presented in Table 1. It can be written as follows:

$$(1)\quad TDIR + \sum_j^S t_j P_j Q_j + SC + UDCB + UDPFI + \sum_j^S UDPE_j + i_D(DPFI^G + DPRB^G) +$$

$$+ \Delta(B + DLG + E\,LG^*) + APFI^C + \sum_j^S APE_j^C + APFI^* + \sum_j^S APE_j^* \equiv$$

$$\equiv W\,B^G + SCG + \sum_j^S P_j Q_j^G + V + SB + \sum_j^S WPEj + \sum_j^N P_j Q_j^{IG} + i_B B + i_G DLG +$$

$$+ E\,i^*\,LG^* + \Delta(CU^G + DPFI^G + DPRB^G + ACB + APFI + \sum_j^S APEj)$$

[5] The distinction between public service enterprises and non-tradable goods or service enterprises is drawn because of the economic importance of the former and the central role played by public tariffs in contributing to public sector deficits in many developing countries.

TABLE 1

GENERAL GOVERNMENT: SOURCES AND USES OF FUNDS

SOURCES		USES	
I. TAX REVENUE		I. CURRENT OPERATIONAL EXPENDITURE	
- Direct taxes	TDIR	- Wage bill	WL
- Indirect taxes	$\Sigma t_j P_j Q_j$	- Social sec. contrib.	SCG
- Social sec. contrib.	SC	- Purchase of goods	$\Sigma P_j Q_j^G$
		- Transfers to the private sector	V
		- Social sec. benefits	SB
		- Transfers to pub. ent.	ΣWPEj
II. NON-TAX CURRENT REVENUE		II. CURRENT FINANCIAL EXPENDITURE	
- Distributed profits		- Interest payments on:	
+ Central Bank	UDCB	+ Public bonds	$i_B B$
+ Public fin. instit.	UDPFI	+ Domestic loans	$i_G DLG$
+ Public enterprises	ΣUDPEj	+ Foreign loans	$Ei^* LG^*$
- Interest receipts from deposits in:			
+ Public fin. instit.	$i_D DPFI^G$		
+ Private banks	$I_D DPRB^G$		
III. CAPITAL REVENUE		III. FIXED CAPITAL EXPENDITURE (REAL INVESTMENT)	
- Bond issues	ΔB	- Real investment	$\Sigma P_j Q_j^{ICB}$
- Domestic loans	ΔLG		
- Foreign loans	$E\ \Delta LG^*$		
- Equity sales to the private sector	ACB^C $APFI^C$ $\Sigma APEj^C$	IV. OTHER CAPITAL EXPENDITURE FINANCIAL INVESTMENT	
		- Currency	ΔCU^G
		- Deposits in pub. fin. instit.	$\Delta DPFI^G$
- Equity sales to the foreign sector	$E\ \Delta ACB^E$ $E\ \Delta APFI^E$ $E\Sigma\Delta APEj^E$	- Deposits in priv. banks	$\Delta DPRB^G$
		- Equity subscription of the central bank	ΔACB
		- Equity subscription of pub. fin. instit.	$\Delta APFI$
		- Equity subscription of public enterprises	$\Delta\Sigma APE$

The general government's current tax revenues correspond to direct and indirect taxes, and to social security contributions.[6] Other taxes that may constitute an important source of current revenues, such as foreign trade, property and real estate taxes, could be easily added if they are not already in indirect taxes. Average indirect tax rates t_j are defined net of sectoral subsidies.

The general government's non-tax current revenue includes both distributed profits by the public enterprises and interest receipts obtained from government deposits in public financial institutions (PFI) and private banks (PRB).

According to the balance sheet, there are three liabilities which are traditional sources of financing or capital revenues of the general government: public bonds issues by the general government, domestic loans from the central bank, and foreign loans.

Aside from traditional financing, privatization or equity sales of public enterprises or public financial institutions are "non-traditional" sources of funds. These shares can be purchased by the private or foreign sectors.[7] When the general government purchases equity from either sector, it uses government

---

[6] A behavioral revenue function for direct taxes is explicitly introduced in section III.2 below.

[7] The purchase by the national private sector is denoted by the superscript C, and the purchase by the foreign sector by an asterisk (*). Note that in the period that follows the sale of equity, the equity stock of the domestic private sector or of the foreign sector increases by the value of the privatization carried out in the previous period. This increases the size of the private bank or of the private enterprise sector (held by the national private sector or by the foreign sector) followed by a reduction in the PFI or PE sectors. To simplify, we consider only purely public or purely private institutions or enterprises, excluding those of mixed property, since these would significantly complicate the consolidation of the public sector.

resources, which implies a sign change of the corresponding items.

The general government's operational expenditure corresponds to the wage bill, total expenditure on current goods, direct transfers to the private sector, subsidies granted to public enterprises, and social security benefit payments.

Current financial expenditure corresponds to interest payments on the three liabilities held by the general government. Fixed capital expenditure or gross investment corresponds to the purchase of capital goods by the general government from each of the relevant production sectors (exportables, importables and non-tradables).

Finally, there are three assets whose increase constitute three uses of funds of the general government: currency, bank deposits (in public financial institutions and private banks), and equity (of the central bank, public enterprises, and public financial institutions).

Central Bank (CB)

The Central Bank's sources and uses of funds table is Table 2. The following identity summarizes it:

$$(2)\quad i_B B^{CB} + i_G DCG + i_{DCPFI}\, DCPFI + i_{DCPRB}\, DCPRB + i_{DCPE} \sum_j^S DCPEj +$$

$$+ i_{DCPRE} \sum_j^S DCPREj + E\, i^*R^* + \Delta\,(CU + RES + ELCB^* + ACB) \equiv WL^{CB} +$$

$$+ SCCB + \sum_j^S P_jQ_j^{ICB} + i_R RES + E\, i^*LCB^* + UDCB + \Delta\,(B^{CB} + DCG +$$

$$+ DCPFI + DCPRB + \sum_j^S DCPEj + \sum_j^S DCPREj) + E\,\Delta R^*$$

In the case of the central bank (as with other public financial institutions and private banks), current revenues are only comprised by interest

TABLE 2

CENTRAL BANK: SOURCES AND USES OF FUNDS

SOURCES		USES	
I. CURRENT REVENUE		I. CURRENT EXPENDITURE	
- Interests receipts from:		- Wage Bill	WL^{CB}
+ Public bonds	$i_B B^{CB}$	- Social sec. contrib.	SCCB
+ Domestic credit to the gen. govt.	$i_G DCG$	- Interest payments on:	
+ Domestic credit to pub. fin. instit.	$i_{DCPFI} DCPFI$	+ Bank reserves	$i_R RES$
+ Domestic credit to private banks	$i_{DCPRB} DCPRB$	+ Foreign loans	$Ei^* LCB^*$
+ Domestic credit to public ent.	$i_{DC} {}_E \Sigma DCPEj$	II. FIXED CAPITAL EXPENDITURE (REAL INVESTMENT)	
+ Domestic credit to private ent.	$i_{DCPREj} DCPREj$	- Real investment	$\Sigma P_j Q_j{}^{ICB}$
+ International reserves	$Ei^* R^*$		
II. CAPITAL REVENUE		III. OTHER CAPITAL EXPENDITURE (FINANCIAL INVESTMENT)	
- Currency	[illegible]	- Public bonds	ΔB^{CB}
- Bank reserves	ΔRES	- Domestic credit to the gen. govt.	ΔDCG
- Foreign loans	$E \Delta LCB^*$	- Domestic credit to the pub. fin. instit.	$\Delta DCPFI$
- Equity issues	ΔACB	- Domestic credit to private banks	$\Delta DCPRB$
		- Domestic credit to public enterprises	$\Delta \Sigma DCPEj$
		- Domestic credit to private enterprises	$\Delta \Sigma DCPREj$
		- International reserves	$E \Delta R$
		IV. DISTRIBUTED PROFITS	
		- Distributed profits	UDCB

payment receipts. However, in contrast to the commercial banking sector which only distinguishes between loan and deposit interest rates, in the case of the central bank we identify a specific rate for each asset or liability.

Capital sources of funds of the central bank are given by the accumulation of domestic monetary liabilities (currency and bank reserves), foreign liabilities (foreign loans), and equity issues.

The central bank's current expenditure corresponds to the wage bill, social security contributions, and interest payments. Fixed capital expenditure is its real investment.

Acquisition of public bonds, extension of domestic credit, and international reserve accumulation constitute the central bank's three forms of financial investment. Its last use of funds item is comprised by profits transfered to the general government.

Public Financial Institutions (PFI)

Table 3 is the sources and uses of funds table for the consolidated public financial sector (excluding the central bank). The following identity summarizes it:

$$
\begin{aligned}
(3)\quad & i_R\, RES^{PFI} + i_B\, B^{PFI} + i_C \left(\sum_j^S LPE_j^{PFI} + \sum_j^S LPRE_j^{PFI} + LC^{PFI}\right) + \Delta\,(DLPFI + \\
& + DPFI + E\, LPFI^{*} + APFI) \equiv WL^{PFI} + SCPFI + \sum_j^S P_j Q_j^{PFII} + i_{DLPFI}\, DLPFI + \\
& + i_D DPFI + E\, i^{*}\, LPFI^{*} + UDPFI + \Delta(CU^{PFI} + RES^{PFI} + B^{PFI} + \\
& + \sum_j^S LPE_j^{PFI} + \sum_j^S LPREj_j^{PFI} + LC^{PFI})
\end{aligned}
$$

TABLE 3

SOURCES AND USES OF FUNDS

OF PUBLIC FINANCIAL INSTITUTIONS

SOURCES		USES	
I. CURRENT REVENUES		I. CURRENT EXPENDITURE	
- Interest payments received for:		- Wage bill	WL^{PFI}
+ Bank reserves	$i_R RES^{PFI}$	- Social sec. contrib.	SCPFI
+ Public bonds	$i_B B^{PFI}$	- Interest payments:	
+ Loans to pub. ent.	$i_C \Sigma CPEj^{PFI}$	+ Domestic loans	$i_{DLPFI} DLPFI$
+ Loans to priv. ent.	$i_C \Sigma CPREj^{PFI}$	+ Deposits	$i_D DPFI$
+ Loans to consumers	$i_C LC^{PFI}$	+ Foreign loans	$Ei^* LPFI$
II. CAPITAL INCOME		II. CAPITAL EXPEND. (REAL INVEST.)	
- Domestic loans	$\Delta DLPFI$	- Real investment	$\Sigma P_j Q_j^{PFII}$
- Deposits	$\Delta DPFI$		
- Foreign loans	$E\Delta LPFI^*$	III. FINANCIAL INVESTMENT	
- Equity issuance	$\Delta APFI$	- Currency	ΔCU^{PFI}
		- Bank Reserves	ΔRES^{PFI}
		- Public bonds	ΔB^{PFI}
		- Loans to pub. ent.	$\Delta \Sigma LPEj^{PFI}$
		- Loans to private	$\Delta \Sigma LPREj^{PFI}$
		- Loans to consumers	ΔLC^{PFI}
		IV. DISTRIBUTED PROFITS	
		- Distributed profits	UDPFI

This budget constraint is similar to that of the central bank. To simplify the model, public financial institutions do not grant loans to the general government, nor to the central bank or private banks.

Public Enterprises (PE)

Finally, we present the sources and uses of funds table for the consolidated public enterprise sector, and the corresponding flow budget constraint. The starting point is the information on each public enterprise sector. According to the sector decomposition proposed in this paper, each enterprise j (j = X, M, N, S) represents a consolidation of public enterprises that operate in that sector. The corresponding identity is the following:

$$(4) \quad (1 - t_j)\, P_j Q_j^{PE} + WPEj + i_B B^{PEj} + i_D\,(DPFI^{PE} + DPRB^{PEj}) + \Delta(DCPEj +$$

$$+ LPEj^{PFI} + LPEj^{PRB} + E\, LPE_j^{*} + APEj) \equiv W\, L^{PEj} + SCPEj + \sum_j^S P_j Q_j^{IPEj} +$$

$$+ i_{DLPE} DLPEj + i_L\,(LPEj^{PFI} + LPEj^{PRB}) + E\, i^{*}\, LPE_j^{*} + UDPEj +$$

$$\Delta(CU^{PE} + B^{PEj} + DPFI^{PEj} + DPRB^{PEj})$$

Public enterprises have three sources of funds: operational revenue comprised by their sales income[8]; non-operational revenue (transfers from the

[8] Throughout the analysis we have assumed no demand or purchases of intermediate goods. Therefore, gross value of production or sales coincide with value added.

TABLE 4

PUBLIC ENTERPRISES: SOURCES AND USES OF FUNDS

SOURCES		USES	
I. OPERATIONAL REVENUE		I. OPERATION EXPENDITURE	
- Sales income	$P_jQ_j^{PE}$	- Wage bill	WL^{PEj}
		- Social Sec. Contrib.	SCPEj
II. NON-OPERATIONAL REVENUE		- Paid interest:	
- Fiscal transfers	WPE_j	+ Domestic	$i_{DLPE}DLPEj$
- Interest received by:		+ Loans from pub. fin. instit.	i_LLPEj^{PFI}
+ Public bonds	$i_B B^{PEj}$	+ Loans from priv. banks	$i_LLPE_j^{PRB}$
+ Deposits in public fin. instit.	$i_D DPFI^{PEj}$	+ Foreign loans	Ei^*LPEj^*
+ Deposits in private banks	$i_D DPRB^{PEj}$	II. CAPITAL EXPENDITURE (REAL INVEST.)	
		- Real investment	$\Sigma P_jQ_j^{IPEj}$
III. CAPITAL REVENUE		III. OTHER CAPITAL INVESTMENT (FINANCIAL INVESTMENT)	
- Domestic credit	ΔDCPEj		
- Loans from public financial instit.	$\Delta LPEj^{PFI}$	- Currency	ΔCU^{PEj}
- Loans from priv.banks	$\Delta LPEJ^{PRB}$	- Public bonds	ΔB^{PEj}
- Foreign loans	E ΔLPEj*	- Deposits in pub. fin. instit.	$\Delta DPFI^{PEj}$
- Equity issues	ΔAPEj	- Deposits in private banks	$\Delta DPRB^{PEj}$
		IV. DISTRIBUTED PROFITS	
		- Distributed profits	UDPEj

general government and interest payments received for bank deposits), and capital revenue (equity issues and loans).

Public enterprises use funds for operational expenditures such as the wage bill, social security contributions, interest payments and indirect taxes. A second use of funds category is fixed capital expenditure, or real investment, which allows increases in production capacity. The remaining surplus is divided among increases in currency, public bonds, and bank deposits. Finally, public enterprises use funds to distribute profits to their owner, the general government.

II.2. The Consolidated Deficit of the Public Sector

Now let's obtain the consolidated public sector deficit. Substituting the distributed profits of the central bank, the public financial institutions, and the public enterprises (from equations (2) - (4)) into the general government budget constraint (equation (1)), and reordering uses and sources of funds, obtain the following identity between the "below the line" financing sources and the "above the line" consolidated public sector deficit:

$$
\begin{aligned}
(5)\quad & \Delta\,(B^{PRB} + \sum_{j}^{S} B^{PREj} + B^{C}) + \Delta(ACB^{C} + APFI^{C} + \sum_{j}^{S} APE_{j}^{C}) + \Delta(CU^{PRB} + \\
& + \sum_{j}^{S} CU^{PREj} + CU^{C} + RES^{PRB}) + \Delta(\sum_{j}^{S} DPFI^{PREj} + DPB^{C} + \Delta(\sum_{j}^{S} LPE_{j}^{PRB}) - \\
& - \Delta(DCPRB + \sum_{j}^{S} DCPREj) - \Delta(\sum_{j}^{S} LPREj^{PB} + LC^{PB}) - \Delta(DPRB^{G} + \sum_{j}^{S} DPRB^{PEj}) + \\
& + E\,\Delta(LG^{*} + LCB^{*} + LPFI^{*} + \sum_{j}^{S} LPE_{j})^{*}) + E\,\Delta(ACB^{*} + APFI^{*} + \sum_{j}^{S} APE_{j}^{*}) - \\
& - E\,\Delta R^{*} \equiv W\,(L^{G} + L^{CB} + L^{PFI} + \sum_{j}^{S} L^{PEj}) + \sum_{j}^{S} P_{j}Q_{j}^{G} + V + SB - TDIR -
\end{aligned}
$$

$$- SCPRB - \sum_{j}^{S} SCPREj - \sum_{j}^{S} t_j P_j Q_j^{PRE} - \sum_{j}^{S} P_j Q_j^{PE} + \sum_{j}^{S} P_j (Q_j^{IF} + Q_j^{ICB} + Q_j^{IPFI} +$$

$$+ \sum_{j}^{S} Q_j^{IPEj}) + i_B (B^{PRB} + \sum_{j}^{S} B^{PREj} + B^{C}) + i_D (\sum_{j}^{S} DPFI^{PREj} + DPFI^{C}) +$$

$$+ i_C (\sum_{j}^{S} LPEj^{PRB}) - (i_{DCPRB} DCPRB + i_{DCPRE} \sum_{j}^{S} DCPREj) - i_C (\sum_{j}^{S} LPREj^{PFI} +$$

$$LC^{PFI}) - i_D (DPRB^{G} + \sum_{j}^{S} DPRB^{PEj}) + E\, i^{*} (LG^{*} + LCB^{*} + LPFI^{*} + \sum_{j}^{S} LPEj^{*} - R^{*})$$

The left-hand side of equation (5) indicates that the consolidated public sector deficit can be financed by issuing public liabilities with the domestic private sector, selling public sector equity to the domestic private sector, selling domestic private liabilities, issuing foreign public liabilities (net of international reserves), and selling public equity stocks to the foreign sector.

The consolidated public deficit is made up of three components. First, the non-financial public deficit, comprised by public expenditure on wages, social security benefits and goods, transfers and real investment, minus direct and indirect taxes, social security contributions of the private sector and revenues from the operation of public enterprises. Second, the financial deficit with the domestic private, and third, the financial deficit with the foreign sector.

The public subsectors' budget constraints are explicitly linked to the budgetary restrictions of three private sub-sectors and the external sector in Appendix 2. There, macroeconomic and financial consistency of all sector accounts is summarized in a flow of funds table.

III. ECONOMIC AND POLICY DETERMINANTS OF PUBLIC SECTOR DEFICITS

This section decomposes the consolidated public sector deficit, in order to quantify the direct contribution of the main economic and policy determinants of public deficits. Section III.1 presents an accounting decomposition of the public deficit, as a fraction of GDP, according to the main budgetary items. After introducing a set of behavioral functions, arbitrage conditions, and identities, the contribution of economic and policy variables to the deficit is quantified in Section III.2. The final derived expression allows to distinguish the effects of foreign and domestic economic shocks on the deficit from those induced by changes in variables under direct control of the policy makers.

III.1. Accounting Decomposition of the Deficit

In decomposing the deficit, equation (5) is used to identify each of the budgetary items that affect the consolidated public sector deficit and its financing. However, it is convenient to simplify this equation by consolidating various assets and liabilities, and to normalize it by dividing it by current-price GDP. We will pursue these two tasks next.

With regard to consolidation, define total public bonds in domestic private hands, B^{PRS}, as:

$$(6) \quad B^{PRS} = B^{PRB} + \sum_{j}^{S} B^{PREj} + B^{C}$$

The monetary base belonging to the domestic private sector, H, is:

$$(7) \quad H \equiv CU^{PRB} + \sum_{j}^{S} CU^{PREj} + CU^{C} + RES^{PRB}$$

Total other liabilities of the public sector in domestic private hands, OP^{SPR}, are:

$$(8) \quad OL^{PRS} \equiv \sum_{j}^{S} DPFI^{PRE} + DPFI^{C} + \sum_{j}^{S} LPEj^{PRB}$$

Total other assets of the public sector, OAPS, (which correspond to liabilities of the private sector in public hands) can be written as:

$$(9) \quad OAPS \equiv DCPRB + \sum_{j}^{S} DCPREj + \sum_{j}^{S} LPRE_{j}^{PB} + LC^{PFI} + DPRB^{C} + \sum_{j}^{S} DPRB^{PEj}$$

Regarding privatizations or equity sales of public financial institutions or of public enterprises, revenues from sales to the domestic private sector and abroad are respectively defined as:

$$(10) \quad \Delta A^{C} \equiv \Delta APFI^{C} + \Delta \sum_{j}^{S} APEj^{C}$$

$$(11) \quad \Delta A^{*} \equiv \Delta APFI^{*} + \Delta \sum_{j}^{S} APEj^{*}$$

The weighted average interest rate paid by the public to the private sector for other liabilities of the public sector, consistent with eq. (18), is defined as:

$$(12) \quad i_{OP} \equiv (i_{D} (\sum_{j}^{S} DPFI^{PRE} + DPFI^{C}) + i_{C} \sum_{j}^{S} LPEj^{PRB})/OL^{PRS}$$

Similarly, the weighted average interest rate paid by the private sector to the public sector corresponding to other public assets, consistent with eq.(19), can be expressed as:

$$(13) \quad i_{OA} \equiv (i_{DLPRB}\, DLPRB + i_{DCPRE} \sum_{j}^{S} LCPREj + i_{L} (\sum_{j}^{S} LPREj^{PB} + LC^{PFI}) +$$

$$+ i_{D} (DPRB^{C} + \sum_{j}^{S} DPRB^{PEj}))/OAPS$$

Aggregate public employment, L^{PS}, is defined as:

$$(14) \quad L^{PS} \equiv L^{G} + L^{CB} + L^{PFI} + \sum_{j}^{S} L^{PEj}$$

Total public investment is:

$$(15) \quad Q_{j}^{IPS} \equiv Q_{j}^{IG} + Q_{j}^{ICB} + Q_{j}^{IPFI} + \sum_{j}^{S} Q_{j}^{IPEj}$$

Next, equation (5) is written as a proportion of output, dividing each of the budgetary items by nominal GDP, PY, where P is the GDP deflator and Y is real GDP. Then each budgetary item is rewritten as its value at a given base period[9] times one plus the percentage variation of its components, minus the percentage change of the GDP deflator (π) and real GDP (n) with respect to the base period, plus a residual. For example, the public wage bill in any current period, as a fraction of nominal GDP, can be expressed as:

$$(16) \quad \frac{W L^{PS}}{P Y} = \{\frac{\overline{W L^{PS}}}{P Y}\} (1 + \hat{W} + \hat{L^{PS}} - \pi - n + R_{WL})$$

where the line above the first fraction denotes the base period value and the caret (^) denotes the percentage change between the base and the current periods. R_{WL} is a residual, which corresponds to the sum of all combinations of the products of percentage changes. To simplify the exposition, this residual is assumed to be zero in all what follows.[10]

Substituting equations (6) - (15) into (5) and expressing all budgetary items as shown in eq. (16), the public sector deficit as a share of current-price GDP is the following:

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[9] The base period could be the preceding period in most applications.

[10] The exact value for R_{WL} in this particular case is:

$$R_{WL} = \{ \pi + (\frac{\hat{1}}{P})\} + \{n + (\frac{\hat{1}}{Y})\} + \hat{W} \hat{L^{PS}} + \hat{W} (\frac{\hat{1}}{P}) +$$

$$+ \hat{W} (\frac{\hat{1}}{Y}) + \hat{L^{PS}} (\frac{\hat{1}}{P}) + L^{PS} (\frac{\hat{1}}{Y}) + \hat{\hat{WL}^{PS}} (\frac{\hat{1}}{P}) + \hat{\hat{WL}^{PS}} (\frac{\hat{1}}{Y}) +$$

$$+ \hat{W} (\frac{\hat{1}}{P}) (\frac{\hat{1}}{Y}) + \hat{L^{PS}} (\frac{\hat{1}}{P}) (\frac{\hat{1}}{Y}) + \hat{\hat{WL}^{PS}} (\frac{\hat{1}}{P}) (\frac{\hat{1}}{Y})$$

This value approaches zero for "small" values of the percentage variations. Therefore it is significantly different from zero in higher inflation countries.

$$(17)\quad \frac{1}{P\,Y}\,\Delta B^{PRS} + \frac{1}{P\,Y}\,\Delta H + \frac{1}{P\,Y}\,\Delta OL^{PRS} - \frac{1}{P\,Y}\,\Delta OAPS + \frac{1}{P\,Y}\,\Delta A^{C} +$$

$$+ \frac{E}{P\,Y}\,\Delta DEN + \frac{E}{P\,Y}\,\Delta A^{*} = \left\{\frac{\overline{WL}^{PS}}{P\,Y}\right\}(1 + \hat{W} + \hat{L}^{PS} - \pi - n) +$$

$$+ \Sigma\left\{\frac{\overline{P_j Q_j^G}}{P\,Y}\right\}(1 + \frac{\hat{P}_j}{P\,Y} + \hat{Q}^G_j - n) + \left[\frac{\overline{V}}{P\,Y}\right](1 + \hat{V} - \pi - n)$$

$$- \left[\frac{\overline{SB}}{P\,Y}\right](1 + \hat{SB} - \pi - n) - \left\{\frac{\overline{TDIR}}{P\,Y}\right\}(1 + \hat{TDIR} - \pi - n -$$

$$\left(\frac{\overline{SCPRB}}{P\,Y}\right](1 + \hat{SCPRB} - \pi - n) - \left[\frac{\overline{\Sigma SCPREj}}{P\,Y}\right](1 + \hat{\Sigma SCPRE}_j - \pi - n)$$

$$- \left[\Sigma\frac{\overline{t_j P_j Q}^{PRE}}{P\,Y}\right](1 + \hat{t}_j + \left(\frac{\hat{P}_j}{P\,Y}\right) + \hat{Q}_j^{PRE} - n) - \left[\Sigma\frac{P_j Q_j^{PE}}{P\,Y}\right](1 +$$

$$+ \left(\frac{\hat{P}_j}{P}\right) + \hat{Q}_j^{PE} - n) + \frac{\overline{\Sigma P_j Q_j}^{PSI}}{P\,Y}\Big](1 + \frac{\hat{P}_j}{P}\;\hat{Q}_j^{PSI} - n) + \bar{i}_B\left[\frac{B^{PRS}}{PY}\right] +$$

$$(i_B - \bar{i}_B)\;\frac{B^{PRS}}{P\,Y} + \bar{i}_{OL}\;\frac{OP^{PRS}}{P\,Y} + (i_{OL} - \bar{i}_{OL})\;\frac{OP^{PRS}}{P\,Y} - \bar{i}_{OA}\;\frac{OAPS}{P\,Y} +$$

$$(i_{OA} - \bar{i}_{OA})\;\frac{OAPS}{P\,Y} - \bar{i}^{*}\;\frac{E}{P\,Y}\,DEN + (i^{*} - \bar{i})\;\frac{E}{P\,Y}\,DEN$$

This form of decomposing the public sector deficit (as a proportion of GDP) offers several advantages. First, it identifies directly each of the budgetary items affected by the change in a particular economic variable; second, it identifies the public subsector to which the budgetary items belongs; and third, a distinction of the budget according to the currency (domestic or foreign) can be made. However, in order to obtain a more meaningful economic decomposition of the deficit, several additional hypotheses have to be introduced next.

III.2. Determinants of Public Deficits

To analyze the economic determinants of the deficit it is useful to rearrange the decomposition expressed in equation (17) and to introduce some relations between the underlying economic variables which cause changes in the deficit.

The behavioral functions, arbitrage conditions, and identities to be introduced next are a revenue function for direct taxes, arbitrage conditions for prices, identities for the GDP deflator and the real exchange rate, and Fisher equations for domestic and international interest rates.

The revenue function for direct taxes depends on the average direct tax rate (τ), real GDP (Y), and the rate of inflations (π).[11]

$$(18)\quad TDIR \equiv \underset{(+)(+)(-)}{f}(\tau, Y, \pi)$$

where the positive dependency of direct taxes on the tax rate assumes that the economy is on the left-hand side of the tax Laffer curve and the negative dependency of inflation reflects the well-known Olivera-Tanzi effect (see Tanzi et al. (1987)). To simplify the presentation of the effects of the independent variables on direct taxes, below we introduce elasticities α_τ, α_Y, and α_π, for the tax rate, GDP and inflation, respectively.

For exportable and importable goods prices consider the following imperfect arbitrage conditions, between domestic and international prices (the latter denoted by asterisks), where the deviation from perfect parity is given by

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[11] The signs of the corresponding partial derivatives are indicated below each variable.

factors ϕ_X and ϕ_M:[12]

$$(19) \quad P_X = \phi_X P_X^* E$$

$$(20) \quad P_M = \phi_M P_M^* E$$

Therefore the changes in the relative prices of exportable and importable goods can be written as:

$$(19') \quad (\hat{P}_X/P) = \hat{\phi}_X + \hat{P}_X^* + \epsilon - \pi$$

$$(20') \quad (\hat{P}_M/P) = \hat{\phi}_M + \hat{P}_M^* + \epsilon - \pi$$

The GDP deflator, P, is a geometric (Cobb-Douglas) average of the four domestic price indices:

$$(21) \quad P = P_X^{\alpha X} P_M^{\alpha M} P_N^{\alpha N} P_S^{(1-\alpha X-\alpha M-\alpha N)}$$

where the αi ($i = X, M, N,$) coefficients are the sector output shares in GDP.

For domestic and foreign nominal interest rates, let's make use of the Fisher equation to distinguish between real rates and inflation rates.[13]

$$(22) \quad i = r + \pi$$

$$(23) \quad i^* = r^* + \pi^*$$

We also define the real or effective exchange rate as the relation between the average foreign and domestic price levels, EP^*/P. The real devaluation rate γ is defined as:[14]

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[12] The variables ϕ_X and ϕM differ from unity due to product differentiation, transportation and intermediation costs, and imperfect competition.

[13] With actual (and not expected) values, the Fisher equation is either an ex-post identity or an ex-ante equation under perfect foresight. In addition, as written in eqs. (22) and (23), it is a valid approximation for low inflation countries, as the product of both rates is excluded from the right-hand side.

[14] Here also products of rates are deleted for simplification.

(24) $\gamma \equiv \epsilon + \pi^* - \pi$

Substituting equations (18), (19'), (20'), (22), (23) and (24) into equation (17), and rearranging the latter, the public deficit decomposition can then be presented according to its economic determinants, as follows:

$$(25) \quad \frac{1}{P\,Y}\Delta B^{PRS} + \frac{1}{P\,Y}\Delta H + \frac{1}{P\,Y}\Delta OL^{PRS} - \frac{1}{P\,Y}\Delta OAPS + \frac{1}{P\,Y}\Delta A^{C} +$$

$$+ \frac{E}{P\,Y}\Delta\,DEN + \frac{E}{P\,Y}\Delta A^{*} \equiv$$

$$\equiv -[\hat{P}_X^* - \pi^*]\left[\left(\frac{\overline{t_X P_X Q_X}^{PRE}}{P\,Y}\right) + \left(\frac{\overline{P_X Q_X}^{PE}}{P\,Y}\right) + \left(\frac{\overline{P_X Q_X}^{G}}{P\,Y}\right) - \left(\frac{\overline{P_X Q_X}^{PSI}}{P\,Y}\right)\right] -$$

$$- [\hat{P}_M^* - \pi^*]\left[\left(\frac{\overline{t_M P_M Q_M}^{PRE}}{P\,Y}\right) + \left(\frac{\overline{P_M Q_M}^{PE}}{P\,Y}\right) - \left(\frac{\overline{P_M Q_M}^{G}}{P\,Y}\right) - \left(\frac{\overline{P_M Q_M}^{PSI}}{P\,Y}\right)\right] +$$

$$+ [\gamma]\left[-\left(\frac{\overline{t_X P_X Q_M}^{PRE}}{P\,Y}\right) - \left(\frac{\overline{t_M P_M Q_M}^{PRE}}{P\,Y}\right) - \left(\frac{\overline{P_X Q_X}^{PE}}{P\,Y}\right) - \left(\frac{\overline{P_M Q_M}^{PE}}{P\,Y}\right) + \left(\frac{\overline{P_X Q_X}^{G}}{P\,Y}\right) +\right.$$

$$\left. + \left(\frac{\overline{P_M Q_M}^{G}}{P\,Y}\right) + \left(\frac{\overline{P_X Q_X}^{PSI}}{P\,Y}\right) + \left(\frac{\overline{P_M Q_M}^{PSI}}{P\,Y}\right)\right] + [\hat{W} - \pi]\left[\left(\frac{\overline{W}\,\overline{L}^{PS}}{P\,Y}\right)\right] -$$

$$- [\hat{P}_N - \pi]\left[\left(\frac{\overline{t_N P_N Q_N}^{PRE}}{P\,Y}\right) + \left(\frac{\overline{P_N Q_N}^{PE}}{P\,Y}\right) - \left(\frac{\overline{P_N Q_N}^{G}}{P\,Y}\right) - \left(\frac{\overline{P_N Q_N}^{PSI}}{P\,Y}\right)\right] -$$

$$- [\hat{P}_S - \pi]\left[\left(\frac{\overline{t_S P_S Q_S}^{PRE}}{P\,Y}\right) + \left(\frac{\overline{P_S Q_S}^{PE}}{P\,Y}\right) - \left(\frac{\overline{P_S Q_S}^{G}}{P\,Y}\right)\right] -$$

$$- [\hat{\phi}_X]\left[\left(\frac{\overline{t_X P_X Q_X}^{PRE}}{P\,Y}\right) + \left(\frac{\overline{P_X Q_X}^{PE}}{P\,Y}\right) - \left(\frac{\overline{P_X Q_X}^{G}}{P}\right) - \left(\frac{\overline{P_X Q_X}^{PSI}}{P\,Y}\right)\right] -$$

$$- [\hat{\phi}_M] \left[\left(\frac{\overline{t_M P_M Q_M}^{PRE}}{P\ Y}\right) + \left(\frac{\overline{P_M Q_M}^{PE}}{P\ Y}\right) - \left(\frac{\overline{P_M Q_M}^{G}}{P\ Y}\right) - \left(\frac{\overline{P_M Q_M}^{PSI}}{P\ Y}\right)\right]$$

$$+ [\pi] \left[\left(\frac{\overline{f(\tau, P, Y)}}{P\ Y}\right) - (1 - \alpha_p)\right]$$

$$- [\hat{Q}_X^{PRE} - n] \left[\left(\frac{\overline{t_X P_X Q_X}^{PRE}}{P\ Y}\right)\right] - [\hat{Q}_M^{PRE} - n] \left[\left(\frac{\overline{t_M P_M Q_M}^{PRE}}{P\ Y}\right)\right] -$$

$$+ [\hat{Q}_N^{PRE} - n] \left[\left(\frac{\overline{t_N P_N Q_N}^{PRE}}{P\ Y}\right)\right] - [\hat{Q}_S^{PRE} - n] \left[\left(\frac{\overline{t_S P_S Q_S}^{PRE}}{P\ Y}\right)\right] -$$

$$- [\hat{Q}_X^{PE} - n] \left[\left(\frac{\overline{P_X Q_X}^{PE}}{P\ Y}\right)\right] - [\hat{Q}_M^{PE} - n] \left[\left(\frac{\overline{P_M Q_M}^{PE}}{P\ Y}\right)\right] -$$

$$- [\hat{Q}_N^{PE} - n] \left[\left(\frac{\overline{P_N Q_N}^{PE}}{P\ Y}\right)\right] - [\hat{Q}_S^{PE} - n] \left[\left(\frac{\overline{P_S Q_S}^{PE}}{P\ Y}\right)\right] -$$

$$- [\ n\ ] \left[\left(\frac{\overline{W\ L}^{PS}}{P\ Y}\right) + \left(\frac{\overline{V}}{P\ Y}\right) + \left(\frac{\overline{SB}}{P\ Y}\right) - \left(\frac{\overline{SCPRB}}{P\ Y}\right) - \left(\frac{\overline{\Sigma SCPRE_j}}{P\ Y}\right) +\right.$$

$$\left. + \left(\frac{\overline{f\ (\tau,\ P,\ Y)}}{P\ Y}\right)\ (\alpha_Y - 1)\right] + [\hat{L}^{PS}] \left[\left(\frac{\overline{W\ L}^{PS}}{P\ Y}\right)\right] + [\hat{Q}_X^{G} - n] \left[\left(\frac{P_X Q_X^{G}}{P\ Y}\right)\right] +$$

$$+ [\hat{Q}_M^{G} - n] \left[\left(\frac{\overline{P_M Q_M}^{G}}{P\ Y}\right)\right] + [\hat{Q}_N^{G} - n] \left[\left(\frac{P_N Q_N^{G}}{P\ Y}\right)\right] + [\hat{Q}_S^{G} - n] \left[\left(\frac{P_S Q_S^{G}}{P\ Y}\right)\right] +$$

$$+ [\hat{Q}_X^{PSI} - n] \left[\left(\frac{\overline{P_X Q_X}^{PSI}}{P\ Y}\right)\right] + [\hat{Q}_M^{PSI} - n] \left[\left(\frac{\overline{P_M Q_M}^{PSI}}{P\ Y}\right)\right] +$$

$$+ [\hat{Q}_N^{PSI} - n] \left[\left(\frac{\overline{P_N Q_N^{PSI}}}{P\,Y}\right)\right] + [\hat{V} - \pi] \left[\left(\frac{\overline{V}}{P\,Y}\right)\right] +$$

$$+ [\hat{SB} - \pi] \left[\left(\frac{\overline{SB}}{P\,Y}\right)\right] - [\Delta\tau] \left[\left(\frac{\overline{f(\tau,\ Y,\ \pi)}}{P\,Y}\right)\frac{a\tau}{\tau}\right] -$$

$$- [\hat{SCPRB} - \pi] \left[\left(\frac{\overline{SCPRB}}{P\,Y}\right)\right] - [\Sigma\hat{SCPREj} - \pi] \left[\left(\frac{\overline{\Sigma SCPREj}}{P\,Y}\right)\right] -$$

$$- [\hat{t}_X] \left[\left(\frac{\overline{t_X P_X Q_X^{PRE}}}{P\,Y}\right)\right] - [\hat{t}_M] \left[\left(\frac{\overline{t_M P_M Q_M^{PRE}}}{P\,Y}\right)\right] - [\hat{t}_N] \left[\left(\frac{\overline{t_N P_N Q_N^{PRE}}}{P\,Y}\right)\right]$$

$$- [\hat{t}_S] \left[\left(\frac{\overline{t_S P_S Q_S^{PRE}}}{P\,Y}\right)\right] + \left[\left(\frac{\overline{W\,L^{PS}}}{P\,Y}\right) + \Sigma \left(\frac{\overline{P_j Q_j^{G}}}{P\,Y}\right) + \left(\frac{\overline{V}}{P\,Y}\right) + \left(\frac{\overline{S\,B}}{P\,Y}\right) -$$

$$- \left(\frac{\overline{f(\tau,Y,\pi)}}{P\,Y}\right) - \left(\frac{\overline{SCPRB}}{P\,Y}\right) - \left(\frac{\overline{\Sigma SCPREj}}{P\,Y}\right) - \Sigma \left(\frac{\overline{t_j P_j Q_j^{PRE}}}{P\,Y}\right) - \Sigma \left(\frac{\overline{P_j Q_j^{PE}}}{P\,Y}\right) +$$

$$+ \Sigma \left(\frac{\overline{P_j Q_j^{PSI}}}{P\,Y}\right)\right] + \Delta\ (r_B + \pi) \left[\frac{\overline{B}^{PRS}}{P\,Y}\right] + \Delta \left[\frac{B^{PRS}}{P\,Y}\right] (\overline{r_B + \pi}) +$$

$$+ \Delta\ (r_{OL} + \pi) \left(\frac{\overline{OL}^{PRS}}{P\,Y}\right) + \Delta \left(\frac{OL^{PRS}}{P\,Y}\right) (\overline{r_{OL} + \pi}) -$$

$$- \Delta\ (r_{OA} + \pi) \left[\frac{\overline{OAPS}}{P\,Y}\right] - \Delta \left[\frac{OAPS}{P\,Y}\right] (\overline{r_{OA} + \pi}) +$$

$$+ \Delta\ (r^* + \pi^*) \left[\frac{\overline{E\ DEN}}{P\,Y}\right] + \Delta \left[\frac{\overline{E\ DEN}}{P\,Y}\right] (\overline{r^* + \pi^*}) +$$

$$+ [(\overline{r_B + \pi}) \left(\frac{B^{PRS}}{P\ Y}\right) + (\overline{r_{OL} + \pi}) \left[\frac{OL^{PRS}}{P\ Y}\right) - (\overline{r_{OA} + \pi}) \left(\frac{OAPS}{P\ Y}\right)$$

$$+ (\overline{r^*_{OA} + \pi^*}) \left(\frac{\overline{E\ DEN}}{P\ Y}\right)]]$$

This equation summarizes the decomposition of the public deficit according to its main macroeconomic and policy determinants. Eq. (25) distinguishes first between the operational and the financial deficit. Each of these is separated into the current-period change of the deficit (explained by its economic determinants) and its base-year level. The current period change identifies line-by-line the determining variable (in the first square bracket) and the affected, base-period budgetary items (in the second square bracket).

A summary of determinants and affected budgetary variables is presented in Table 5, which follows the order of eq. (25). It separates the determinants by their effects on the operational and the financial deficits. The major categories of determinants are changes in relative prices, domestic inflation, sector and aggregate domestic growth, and changes in public policy variables (all of them affecting the operational devicit); and changes in nominal interest rates and debt/output ratios (which impact on the financial deficit).

A simple rearrangement of determinants, slightly more relevant for policy-making purposes, enables to distinguish between three main sets of determinants: Foreign variable shocks, domestic macroeconomic and sector variable shocks (exogenous to policy makers), and changes in public policy variables (under control of policy authorities). This rearrangement would allow, for instance, to add the effects of inflation on tax revenue and on public debt interest payments, by separating effects 18 and 19 in Table 5 into the real interest rate

and inflation rate effects on public interest payments.

The decomposition of the deficit summarized by eq. (25) is performed on a cash base inasmuch as it does not incorporate capital gains. An alternative principle is accruals base. The latter incorporates, among other differences between accruals and cash flows, capital gains and losses due to changes in prices of assets and liabilities.

Appendix 3 presents a decomposition of the net public debt/output ratio, which differs from the cash-flow decomposition of eq. (25) by considering capital gains and losses due to domestic inflation and nominal exchange rate devaluation. This form of presenting the deficit, which reflects the change in the net wealth position of the consolidated public sector, is particularly useful when addressing solvency questions as done, for instance, by Buiter (1988).

TABLE 5

DECOMPOSITION OF THE PUBLIC DEFICIT ACCORDING TO ITS ECONOMIC DETERMINANTS

EFFECT #	ECONOMIC AND POLICY DETERMINANTS VARIABLE	AFFECTED BUDGETARY VARIABLES
A.	**DECOMPOSITION OF THE OPERATIONAL DEFICIT**	
	Changes in Relative Prices	
1.	Δ Terms of trade	
1.1	Δ^+ Relative Export Prices $(\hat{P}^*_X - \pi^*)$	1.1 Revenue from direct taxes, revenues of public enterprises, purchases of consumption and capital goods.
1.2	Δ^+ Relative Import Prices $(\hat{P}^*_M - \pi^*)$	1.2 See 1.1
2.	Real Devaluation (γ)	2. See 1.1
3.	Δ^+ Real Wages $(\hat{W} - \pi)$	3. Wage Bill
4.	Δ^+ Relative Prices of Non-tradables $(\hat{P}_N - \pi)$	4. See 1.1

5. Δ^+ Relative Prices of Public Services $(\hat{P}_S - \pi)$	5. Revenue from direct taxes, revenues of public enterprises, expenditure on public services.
6. Changes in Competitiveness	
6.1 Δ^+ in Deviation factor of export prices (ϕ_X)	6.1 See 1.1
6.2 Δ^+ in Deviation factor of import prices (ϕ_M)	6.2 See 1.1
<u>Domestic Inflation</u>	
7. Inflation Rate (π)	7. Revenue from direct taxes
<u>Growth</u>	
8. Relative sector growth (in relation to GDP growth)	
8.1 Private Sector ($\hat{Q}_X^{PRE} - n$, $\hat{Q}_M^{PRE} - n$, $\hat{Q}_N^{PRE} - n$, $\hat{Q}_S^{PRE} - n$)	8.1 Revenue from indirect taxes
8.2 Public Sector ($\hat{Q}_X^{PE} - n$, $\hat{Q}_M^{PE} - n$, $\hat{Q}_N^{PE} - n$, $\hat{Q}_S^{PE} - n$)	8.2 Revenue of public enterprises

9.	GDP growth (n)	9. Wage bill, transfers, social security benefits, direct taxes, contribution of the private sectors to social security
<u>Changes in Public Policies</u>		
10.	Δ^+ Public employment ($\hat{L}^{SP}$)	10. Wage bill
11.	Δ^+ Real current expenditure on goods relative to GDP growth ($\hat{Q}^G_X - n$, $\hat{Q}^G_M - n$, $\hat{Q}^G_N - n$, $\hat{Q}^G_S - n$)	11. Total current expenditure
12.	Δ^+ Real current expenditure on capital goods relative to GDP growth ($\hat{Q}^{IPS}_X - n$, $\hat{Q}^{IPS}_M - n$, $\hat{Q}^{IPS}_N - n$, $\hat{Q}^{IPS}_S - n$)	12. Total expenditure on capital goods
13.	Δ^+ real expenditure on transfers ($\hat{V}-\pi$)	13. Total transfers
14.	Δ^+ real expenditure on social security benefits ($\hat{SB}-\pi$)	14. Social Security benefits
15.	Δ^+ direct tax rates ($\Delta\tau$)	15. Revenue from direct taxes
16.	Δ^+ real contributions of the private sector to social security ($\hat{SCPRB}-\pi$, $\Sigma\hat{SCRPEj}-\pi$)	16. Social Security Contributions

17.	Δ^+ Indirect tax rates (t_X, t_M, t_N)	17. Revenue from indirect taxes

B. DECOMPOSITION OF THE FINANCIAL DEFICIT

Changes in Nominal Interest Rates

18.	Δ^+ Domestic nominal interest rates	18. Net domestic public debt
19.	Δ^+ Foreign nominal interest rates	19. Net foreign public debt

Changes in the Public Debt/Output Ratio

20.	Δ^+ Domestic debt/output ratio	20. Domestic debt interest payments
21.	Δ^+ Net foreign debt/output ratio	21. Net foreign public debt interest payments

IV. FINAL REMARKS

This paper has developed an analytical framework for quantifying the impact of the most important economic and policy variables on the public deficit. The model was derived from combining the consolidated public sector budget constraint (taking into account the relevant financial and non-finacial public subsectors) with a number of behavioral equations and identities for some key macroeconomic variables. It seems to be particularly useful for measuring, simulating, or projecting the effects of changes in the main foreign and domestic economic variables, and policy variables on the public deficit. However, lack of detailed information on the budget structure could force to simplify the methodology, as done for instance by Schmidt-Hebbel and Webb (1989) in their application to Colombia and Venezuela.

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APPENDIX 1: DEFINITIONS AND IDENTITIES

1. DEFINITIONS OF PUBLIC SECTOR ASSETS AND LIABILITIES

Public Sector Domestic Liabilities (in domestic currency)

B:	Bonds issued by the general government
DCG:	Domestic credit (from the central bank) to the general government
CU:	Currency (bills and coins issued by the central bank)
RES:	Reserves of the commercial banks held by the central bank
ACB:	Equity value (stock) of the central bank
DCPFI:	Domestic credit (from the central bank to public financial institutions
DPFI:	Deposits in public financial institutions
APFI:	Equity value (stock) of public financial institutions
DCPEj:	Domestic credit (from the central bank) to public enterprises of sector j
LPEj:	Commercial bank loans to public enterprises
APEj:	Equity value (stock) of public enterprises of sector j

Public Sector Foreign Liabilities (in foreign currency)

LG^*	Foreign loans to the general government
LCB^*:	Foreign loans to the central bank
$LPFI^*$:	Foreign loans to public financial institutions
$LPEj^*$:	Foreign loans to public enterprises of sector j

Public Sector Domestic Assets (in national currency)

K^G:	Real capital of the general government
K^{CB}:	Real capital of the central bank
K^{PFI}:	Real capital of public financial institutions
K^{PEj}:	Real capital of private enterprises of sector j

Public Sector Foreign Assets (in foreign currency)

R^*:	International reserves of the central bank

2. DEFINITIONS OF PRIVATE SECTOR ASSETS AND LIABILITIES

Private Sector Domestic Liabilities

LC: Commercial bank loans to consumers
DCPRB: Domestic credit (from the central bank) to private banks
DPRB: Deposits in private banks
APRB: Equity value (stock) of the private banks
DCPREj: Domestic credit (from the central bank) to private enterprises of sector j
LPREj: Loans from private banks to private enterprises of sector j
APREj: Equity value (stock) of private enterprises of sector j

Private Sector Foreign Liabilities

LC^*: Foreign loans to consumers
$LPRB^*$: Foreign loans to private banks
$LPREj^*$: Foreign loans to private enterprises of sector j.

Private Sector Domestic Assets

K^{PRB}: Real capital of private banks
K^{PREJ}: Real capital of private enterprises of sector j

3. ADDITIONAL DEFINITIONS AND IDENTITIES

H: Monetary base
NWG: Net wealth of the general government
NWC: Net wealth of consumers
E: Nominal exchange rate (units of domestic currency per unit of foreign currency)

With regard to the symbols used for assets and liabilities, base letters denote the liability and the sector which issued it, while superscripts denote the sector which holds the corresponding financial liability or owns the corresponding real capital stock. Therefore the following adding-up restrictions hold for each liability:

$$B \equiv B^{CB} + B^{PFI} + \sum_{j}^{S} B^{PEj} + CU^{C} + CU^{PRB} + \sum_{j}^{S} B^{PREj}$$

$$CU \equiv CU^{G} + CU^{PFI} + \sum_{j}^{S} CU^{PEj} + CU^{C} + CU^{PRB} + \sum_{j}^{S} CU^{PREj}$$

$$RES \equiv RES^{PFI} + RES^{PRB}$$

$$DPB \equiv DPB^{G} + \sum_{j}^{S} DPB^{PEj} + DPB^{C} + \sum_{j}^{S} DPB^{PREj}$$

$$LPEj \equiv LPEj^{PFI} + LPEj^{PRB}$$

$$LC \equiv LC^{PFI} + LPEj^{PRB}$$

$$DPRB \equiv DPRB^{G} + \sum DPRB^{PEj} + DPRB^{C} + \sum_{j}^{S} DPRB$$

$$LPREj \equiv LPREj^{PFi} + LPREj^{PRB}$$

4. DEFINITIONS OF OTHER VARIABLES

Taxes and Subsidies

TDIR: Direct taxes
V: Fiscal transfers to consumers
WPEj: Fiscal subsidies to public enterprises of sector j
tj: Net indirect tax rate (net of subsidies) of sector j
SC: Social security contribution (payments)
SB: Social security benefits paid to consumers

Distributed Profits

UD: Profits distributed by the central bank (UDCB), public financial institutions (UDPFI), public enterprises of sector j, for j = X, M, N, S (UDPEj), private banks (UDPRB), and private enterprises of sector j, for j = X, M, N, S (UDPREj)

Employment

L^{S} Employment in sector S, for S = G (general government), CB (central bank), PFI (public financial institution), PEj (public enterprises of sector j), PRB (private banks), and PREj (private enterprises of sector j)

Prices, Wages and Interest Rates

P_j: Unit price of the composite good produced by sector j
W: Unit wage
i_S: Interest rate which corresponds to liability or asset S, for S = B (public bonds) DCG, DCPFI, DCPRB, DCPE, DCPRB (domestic credit to various borrowers), R (international reserves), D (bank deposits), and L (bank loans)
i^*: Interest rate on foreign liabilities and assets

Production and Demand

Q^S_j: Volume of composite good produced by sector j, enterprise of sector S, for S = PE (public enterprise), PRE (private enterprise)

Q^{IS}_j Volume of composite good produced by sector j, demanded for investment by sector S, for S = G, CB, PFI, PEj, PRB, PREj

Q^C_j: Volume of composite good produced by sector j, demanded for private consumption

Q^G_j: Volume of composite good produced by sector j, demanded for public consumption

APPENDIX 2

ECONOMY-WIDE ACCOUNTING CONSISTENCY

This appendix combines the public sector's flow budget constraint with those of the domestic private sector and the foreign sector, to provide an economy-wide framework of accounting consistency. First the domestic private sector's budget constraint is introduced. Then the public and the national private sectors are consolidated in order to derive the foreign resource constraint, the balance of payments identity and the macroeconomic identity between domestic savings and domestic investment. Economy-wide financial and macroeconomic consistency is summarized in a flow of funds table.

1. Private Sector

The domestic private sector is comprised by three subsectors: owners of factors of production (consumers or families), private banks (which include all non-public owned financial institutions), and private firms.

Consumers own labor and equity of the two other private sub-sectors.[15] The source and use of funds identity for consumers - factor owners is the following:

$$
\begin{aligned}
(B.1)\quad & [L^{G} + L^{CB} + L^{PFI} + \Sigma L^{PEj} + L^{PRB} + \Sigma L^{PREj}\ ] + UDPRB^{C} + \Sigma UDPREj^{C} + i\, B_{B}^{C} + \\
& + i\,[DPFI^{C} + DPRB^{C}] + V + SB + \Delta\,[LC^{PFI} + LC^{PRB} + E\,LC^{*}] \equiv \Sigma P_{j} Q_{j}^{C} + \\
& + TDIR + i_{L}\,[LC^{PFI} + LC^{PRB}] + E\,i^{*}\,L^{*} + \Delta\,[U^{C} + B^{C} + DPFI^{C} + DPRB^{C} + \\
& + APRB + \Sigma APEj + ACB^{C} + APFI^{C} + \Sigma APEj^{C}]
\end{aligned}
$$

---

[15] No distinction is made here between capitalists and workers.

Factor income received by consumers corresponds to their ownership of labor, bank and private firm equity, and financial assets (bonds and bank deposits). Other sources of income are transfers and social security benefits received from the general government.

People use their funds for consumption expenditure, direct tax payments, and servicing their domestic and foreign debts. Direct taxes are assumed to be paid entirely by consumers and not by enterprises.

Net accumulation of assets (assets minus liabilities) reflects an increase or improvement in the consumers' net position, as defined by their balance sheet introduced in appendix 3.

The budget constraint of private banks is similar to that of public financial institutions (see eq. 3):

$$(B.2)\ i_R\, RES^{PRB} + i_B\, B^{PRB} + i_L\, [\Sigma LPEj^{PRB} + \Sigma LPREj^{PRB} + LC^{PRB}] + \Delta\, [DCPRB +$$

$$+ DPRB + E\, LPRB^{*} + APRB] \equiv W\, L^{PRB} + SCPRB + P_j Q_j^{IPRB} + i_{DCPRB} DCBRB +$$

$$+ i\, DPRB + E\, i^{*}\, LPRB^{*} + UDPRB + \Delta\, [CU^{PRB} + RES^{PRB} + B^{PRB} + \Sigma LPE_j^{PRB} +$$

$$+ \Sigma LPREj^{PRB} + LC^{PRB}]$$

Finally, the use- and source-of-funds identity for the consolidated private firms of sector j (j = X, M, N, S), which is very similar to eq. (4) for public enterprises, is given by:

$$(B.3)\ (1 - t_j)\, P_j Q_j^{PRE} + i_B\, B^{PREj} + i_D\, [DPB^{PREj} + DPRB^{PREj}] + \Delta\, [DCPREj +$$

$$+ LPREj^{PFI} + LPREj^{PRB} + E\, LPREJ^{*} + APREj] \equiv W\, L^{PREj} + SCPREj +$$

$$+ \Sigma P_j Q_j^{IPREj} + i_{DCPRE} DCPREj + i_L [LPREj^{PFI} + LPREj^{PRB}] + E\ i^*\ LPREj^* +$$

$$+ UDPREj + \Delta\ [CU^{PREj} + B^{PREj} + DPFI^{PREj} + DPRB^{PREj}]$$

Substituting distributed profits (UD) of private commercial banks and private enterprises (from equations (B.2) - (B.3)) into the consumers' budget constraint (equation (B.1)), the following budget equation for the consolidated private sector is obtained:

$$(B.4)\ \Delta\ [DCPRB + \Sigma DCPREj] + \Delta\ [\Sigma LPREj^{PB} + LC^{PB}] + \Delta\ [DPRB^{G} + \Sigma DPRB^{PEj}] -$$

$$- \Delta\ [B^{PRB} + \Sigma B^{PREj} + B^{C}] - \Delta\ [ACB^{C} + APFI^{C} + \Sigma APE_j^{C}] -$$

$$\Delta\ [CU^{PRB} + \Sigma CU^{PREj} + CU^{C} + RES^{PRB}] - [\Sigma DPFI^{PREj} + DPFI^{C}] -$$

$$- \Delta\ [\Sigma LPE_j^{PRB}] + E\ \ [LC^* + LPRB^* + \Sigma LPRE_j^*] \equiv \Sigma\ P_j Q_j^{C} + TDIR +$$

$$+ SCPRB + \Sigma\ SCPRE_j + \Sigma\ t_j P_j Q_j^{PRE} - W\ [L^{G} + L^{CB} + L^{PFI} + \Sigma L^{PEj}] - V -$$

$$- SB - \Sigma P_j Q_j^{PRE} + \Sigma P_j\ [Q_j^{IPRB} + \Sigma\ Q_j^{IPREj}] + [i_{DCPRB} DCPRB +$$

$$+ i_{DCPRE} \Sigma DCPREj] + i_L\ [\Sigma LPRE_j^{PFI} + LC^{PFI}] + i_D\ [DPRB^{G} +$$

$$+ \Sigma DPRB^{PRj}] - i_B\ [B^{PRB} + \Sigma B^{PREj} + B^{C}] - i_D\ [\Sigma\ DPFI^{DPREj} + DPFI^{C}] -$$

$$- i_L\ [\Sigma LPE_j^{PRB}] + E\ i^*\ [LC^* + LPRB^* + \Sigma LPRE_j^*]$$

The consolidated deficit of the private sector can be financed by selling private liabilities to the public sector, selling public liabilities back to the public sector, purchasing less equity from the public sector or selling private liabilities to the foreign sector. Obviously, portfolio changes related to public liabilities have their exact counterpart, with opposite sign, in equation

(5) (the consolidated public sector). It is likewise with expenditure and income flows that involve transactions between the private and public sectors, as reflected in the right hand sides of equations (5) and (B.4).

2. Foreign Constraint

Now we can consolidate the domestic private and public sectors. Combining equations (B.4) and (5), the identity between the country's uses and sources of funds is obtained:

$$(B.5)\quad E\,\Delta\,[ACB^{*} + APFI^{*} + \Sigma APE_j^{*} + L^{*} - R^{*}] \equiv \Sigma P_j Q_j^{C} + \Sigma\, P_j [Q_j^{IF} + Q_j^{ICB} + Q_j^{IPB} + \Sigma Q_j^{IPEj} + \Sigma Q_j^{IPREj}] + \Sigma P_j\, Q_j^{G} - [\Sigma P_j\, Q_j^{PE} + \Sigma P_j\, Q_j^{PRE}] + Ei^{*}\,[UDPRB^{*} + \Sigma\, UDPRE_j^{*} + L^{*} - R^{*}]$$

This is obviously the foreign sector budget constraint or the balance of payments identity. L^{*} is total foreign debt defined as:

$$(B.6)\quad L^{*} \equiv LG^{*} + LCB^{*} + LPFI^{*} + \Sigma LPE_j^{*} + LC^{*} + LPRB^{*} + \Sigma LPRE_j^{*}$$

The fact that (B.5) is the balance of payments identity is more transparent when replacing the aggregate demand components (private consumption, gross domestic investment) by its commonly known symbols (C, I, and G) and output by GDP, and rearranging (B.5) in terms of foreign reserve accumulation as the dependent variable:

$$(B.7)\quad E\,\Delta\,R^{*} \equiv GDP - (C + I + G) + E\,[UDPRB^{*} + \Sigma UDPRE_j^{*}] + E\,i^{*}\,[L^{*} - R^{*}] + E\Delta L^{*} + E\,\Delta\,[ACB^{*} + APFI^{*} + \Sigma APE_j^{*})$$

which defines international reserve accumulation as the excess of GDP over domestic absorption (the trade balance) plus the sum of the financial service balance and the capital account balance.

3. Macroeconomic and Financial Consolidation

The fact that the excess of GDP over absorption is equal to net exports of goods and non-factor services is seen more clearly when substituting into equation (B.7) the following equilibrium conditions for the markets of non-tradable goods and public services, respectively:

$$(B.8)\quad P_N Q_N^{PE} + P_N Q_N^{PRE} = P_N Q_N^{C} = P_N Q_N^{I} + P_N Q_N^{G}$$

$$(B.9)\quad P_S Q_S^{PE} = P_S Q_S^{C} + P_S Q_S^{G}$$

Hence obtaining:

$$(B.10)\quad E\,\Delta R^{*} \equiv P_X [Q_X^{PE} + Q_X^{PRE} - Q_X^{C} - Q_X^{I} - Q_X^{G}] + P_M [Q_M^{PE} + Q_M^{PRE} - Q_M^{C} - Q_M^{I} - Q_M^{G}] + E\,[UDPRB^{*} + \Sigma\, UDPRE_j^{*}] + E\, i^{*}\,[L^{*} - R^{*}] + E\,\Delta L^{*} + E\,\Delta[ACB^{*} + APFI^{*} + \Sigma APE_j^{*}]$$

Finally, let's put all the pieces together to derive financial and macroeconomic consolidation for the entire economy. This is done by representing budget restrictions of all sectors (equations (1), (2), (3), (4), (B.1), (B.2), (B.3), and (B.10)) in flow of funds Table B.1. Its first line represents the difference between each domestic sector's investment and savings (the latter summarizing all current account transactions), which is equal to foreign savings or minus the current account surplus (CAS):

$$(B.11)\ [I^{G} + I^{CB} + I^{PFI} + \Sigma I^{PEj} + I^{PRB} + \Sigma I^{PREj}] - [S^{G} + S^{CB} + S^{PFI} + \\ + \Sigma S^{PEj} + S^{C} + S^{PRB} + \Sigma S^{PREj}] + [G - T] \equiv - CAS$$

Each sector's excess of investment over saving goes into net financial asset accumulation. These comprise all capital account transactions (other than real capital accumulation), and are listed in line II of table B.1.

Mutual consistency of financial asset transactions is explicitly reflected by having asset flow demands equaled to flow supplies. Overall macroeconomic and financial consistency is ensured by having the sum of the domestic sectors' budget constraint equal to the balance of payments.[16]

[16] Note that the signs of the variables in lines I and II and columns A-C of Table B.1 are defined such that the sums in each line and column are equal to zero.

Table B.1

ECONOMY-WIDE FLOW OF FUNDS TABLE

	A. Public Sector				B. Private Sector			C. External Sector
	G General Government	CB Central Bank	PFI Public Fin. Instit.	PE Public Enterprises	C Consumers	PRB Private Banks	PRE Private Enterprises	
I. Savings-Investment	$I^G - S^G$	$I^{CB} - S^{CB}$	$I^{PFI} - S^{PFI}$	$\Sigma(I^{PEj} - S^{PEj})$	$-S^C$	$I^{PRB} - S^{PRB}$	$\Sigma(I^{PREj} - S^{PREj})$	CAS
II. Financial Asset Accumulation:								
1. Currency	ΔCU^G	$-\Delta CU$	ΔCU^{PFI}	$\Sigma\Delta CU^{PEj}$	ΔCU^C	ΔCU^{PRB}	$\Sigma\Delta CU^{PREj}$	
2. Adjustment		$-\Delta RES$	ΔRES^{PFI}			ΔRES^{PRB}		
3. Deposits in Public Financial Instit.	$\Delta DPFI^G$		$\Delta DPFI$	$\Sigma\Delta DPFI^{PEj}$	$\Delta DPFI^C$		$\Sigma\Delta DPFI^{PREj}$	
4. Deposits in Private Banks	$\Delta DPRB^G$			$\Sigma\Delta DPRB^{PEj}$	$\Delta DPRB^C$	$-\Delta DPRBC$	$\Sigma\Delta DPRB^{PREj}$	
5. Domestic Credit from Central Bank	ΔDCG	ΔDC	$\Delta DCPRI$	$-\Sigma\Delta DCPEj$		$-\Delta DCPRB$	$-\Sigma\Delta DCPREj$	
6. Loans from Public Financial Instit.			ΔL^{PFI}	$-\Sigma\Delta LPEj^{PFI}$	$-\Delta LC^{PFI}$		$-\Sigma\Delta LPREj^{PFI}$	
7. Loans from Private Banks				$-\Sigma LPEj^{PRB}$	$-\Delta LC^{PRB}$	ΔL^{PRB}	$-\Sigma\Delta PREj^{PRB}$	
8. Public Bonds	$-\Delta B$	ΔB^{CB}	ΔB^{PFI}	$\Sigma\Delta B^{PEj}$	ΔB^C	ΔB^{PRB}	$\Sigma\Delta B^{PREj}$	
9. Public Sector Equity	ΔACB	$-\Delta ACB$						
	$\Delta APFI$		$-\Delta APFI$					
	$\Sigma\Delta APEj$			$-\Sigma\Delta APEj$				
10. Private Sector					$\Delta APRB$	$-\Delta APRB$		
					$\Sigma\Delta APREj$		$-\Sigma\Delta APREj$	
11. Foreign Loans	$-E\Delta LG^*$	$-E\Delta LPFI^*$	$-E\Delta LPFI^*$	$-E\Delta LPEj^*$	$-E\Delta LC^*$	$-E\Delta LPRB^*$	$-E\Delta LPREj^*$	$E\Delta L^*$
12. International Reserves		$E\Delta R^*$						$-E\Delta R^*$

APPENDIX 3: BALANCE SHEETS OF PUBLIC AND PRIVATE SECTORS

Table C.1

BALANCE SHEETS OF THE PUBLIC SECTOR

(In domestic currency)

General Government

Assets	Liabilities
CU^G	B
$DPFI^G$	DCG
$DPRB^G$	$E\ LG^*$
ACB	NWG
APFI	
$\sum_j^S APE$	
K^F	

Central Bank

Assets	Liabilities
B^{CB}	CU
DCG	RES
DCPFI	
DCPRB	
$\sum_j^S DCPEj$	
$\sum_j^S DCPREj$	
$E\ R^*$	
H	H
	LCB^*
K^{CB}	ACB

Public Financial Institutions

Assets	Liabilities
CU^{PFI}	DCPFI
RES^{PFI}	DPFI
B^{PFI}	$E\ LPFI^*$
$\sum_j^S LPEj^{PFI}$	APFI
$\sum_j^S LPREj^{PFI}$	
LC^{PFI}	
K^{PFI}	

Public Enterprises of Sector j

Assets	Liabilities
CU^{PEj}	DCPEj
B^{PEj}	$LPEj^{PFI}$
$DPFI^{PEj}$	$LPEj^{PRB}$
$DPRB^{PEj}$	$E\ LPEj^*$
K^{PEj}	APEj

Table C.2

BALANCE SHEETS OF THE PRIVATE SECTOR

(In domestic currency)

Consumers

Assets	Liabilities
CU^{C}	LC^{PFI}
B^{C}	LC^{PRB}
$DPFI^{C}$	$E\ LC^{*}$
APRB	NWC
$\sum_{j}^{S} APREj$	

Private Banks

Assets	Liabilities
CU^{PRB}	DCPRB
RES^{PRB}	DPRB
B^{PRB}	$E\ LPRB^{*}$
$\sum_{j}^{S} LPEj^{PRB}$	APRB
$\sum_{j}^{S} LPREj^{PRB}$	
LC^{PRB}	
K^{PRB}	

Private Enterprises of Sector j

Assets	Liabilities
CU^{PREj}	DCPREj
B^{PREj}	$LPREj^{PFI}$
$DPFI^{PREj}$	$LPREj^{PRB}$
$DPRB^{PREj}$	$E\ LPREj^{*}$
K^{PREj}	APREj

APPENDIX 4

ECONOMIC AND POLICY DETERMINANTS OF THE PUBLIC DEBT OUTPUT RATIO

This appendix derives a decomposition of the public sector deficit consistent with accruals base. This implies considering capital gains and losses on public sectors asset and liability holdings. Hence the cash-flow deficit measure of eq. (25) in section III is substituted by the change in real net liabilities of the public sector (as a fraction of GDP), reflecting changes in net wealth poistions of the consolidated public sector. As in Buiter (1988), no difference is made between average and end-of-period valuation of assets and liabilities in what follows. (For a detailed compatibilization of cash flow and balance sheet accounts which distinguishes between average and end-of-period price levels and exchange rates see Khadr and Schmidt-Hebbel (1989a, b)).

The difference between the procedure followed here and eq. (25) is that the change in nominal asset (or liability) holdings divided by nominal GDP (the left-hand side of eq. (25)) is rewritten as the change in the corresponding asset (or liability)-output ratio, plus the capital losses (or gains) from domestic inflation and nominal exchange rate devaluation, plus the change in the ratio due to real GDP growth.

For instance, the changes in nominal public bonds and net external debt, each divided by nominal GDP, are written as:[17]

$$(D.1) \qquad \frac{\Delta B^{PRS}}{P\,Y} = \Delta b^{PRS} + b(\pi + n)$$

[17] The products of the corresponding rates are assumed to be zero.

$$(D.2)\quad \frac{E}{P\,Y}\,\Delta DEN = \Delta den + den(\pi - \epsilon + n)$$

where $b^{PRS} = B^{PRS}/(P\,Y)$ and $den = (E\,DEN)/(PY)$ are the liability-output ratios.

Consistent with balance sheet or accuals base, rewrite the public deficit as the change in net liability-output ratios, which implies having on the right-hand side the corresponding capital gains and losses, ratio changes due to growth, and interest payments. For all terms involving b^{PRS} and den, this implies the following expression:

$$(D.3)\quad \Delta b^{PRS} + \ldots + \Delta den =$$
$$= \ldots - b^{PRS}(\pi + n) + (r + \pi)b^{PRS} + \ldots - den(\pi - \epsilon + n) + (r^{*} + \pi^{*})den + \ldots$$
$$= \ldots + [\mu]den + [r^{*} - n][b^{PRS} + den] + [r_{B} - r^{*}][b^{PRS}] + \ldots$$

Substituting the remaining three sources (other than ΔA^{C} and ΔA^{*}) of financing on the left-hand side of eq. (25) by expressions similar to (D.1) and (D.2), and rearranging as in (D.3), obtain the following decomposition of the increase in the net public debt/output ratio according to its economic and policy determinants:

$$(D.4)\quad \Delta b^{PRS} + \Delta h + \Delta ol^{PRS} - \Delta oaps + \Delta den = -\frac{1}{PY}\Delta A^{C} - \frac{E}{PY}\Delta A^{*} -$$
$$- [\hat{P}_{X}^{*} - \pi^{*}]\left[\left(\frac{\overline{t_{X}P_{X}Q_{X}^{PRE}}}{P\,Y}\right) + \left(\frac{\overline{P_{X}Q_{X}^{PE}}}{P\,Y}\right) + \left(\frac{\overline{P_{X}Q_{X}^{G}}}{P\,Y}\right) - \left(\frac{\overline{P_{X}Q_{X}^{IPS}}}{P\,Y}\right)\right]$$
$$- [\hat{P}_{M}^{*} - \pi^{*}]\left[\left(\frac{\overline{t_{M}P_{M}Q_{M}}^{PRE}}{P\,Y}\right) + \left(\frac{\overline{P_{M}Q_{M}}^{PE}}{P\,Y}\right) - \left(\frac{\overline{P_{M}Q_{M}}^{G}}{P\,Y}\right) - \left(\frac{\overline{P_{M}Q_{M}}^{IPS}}{P\,Y}\right)\right] +$$

$$+ [\gamma] \left[den - \left(\frac{\overline{t_X P_X Q_M^{PRE}}}{P\,Y}\right) - \left(\frac{\overline{t_M P_M Q_M^{PRE}}}{P\,Y}\right) - \left(\frac{\overline{P_X Q_X^{PE}}}{P\,Y}\right) - \left(\frac{\overline{P_M Q_M^{PE}}}{P\,Y}\right) + \left(\frac{\overline{P_X Q_X^{G}}}{P\,Y}\right) + \right.$$

$$\left. + \left(\frac{\overline{P_M Q_M^{G}}}{P\,Y}\right) + \left(\frac{\overline{P_X Q_X^{IPS}}}{P\,Y}\right) + \left(\frac{\overline{P_M Q_M^{IPS}}}{P\,Y}\right) \right] + [\hat{W} - \pi] \left[\left(\frac{\overline{W}\,\overline{L}^{PS}}{P\,Y}\right) \right] -$$

$$- [\hat{P}_N - \pi] \left[\left(\frac{\overline{t_N P_N Q_N^{PRE}}}{P\,Y}\right) + \left(\frac{\overline{P_N Q_N^{PE}}}{P\,Y}\right) - \left(\frac{\overline{P_N Q_N^{G}}}{P\,Y}\right) - \left(\frac{\overline{P_N Q_N^{IPS}}}{P\,Y}\right) \right] -$$

$$- [\hat{P}_S - \pi] \left[\left(\frac{\overline{t_S P_S Q_S^{PRE}}}{P\,Y}\right) + \left(\frac{\overline{P_S Q_S^{PE}}}{P\,Y}\right) - \left(\frac{\overline{P_S Q_S^{G}}}{P\,Y}\right) \right] -$$

$$- [\hat{\phi}_X] \left[\left(\frac{\overline{t_X P_X Q_X^{PRE}}}{P\,Y}\right) + \left(\frac{\overline{P_X Q_X^{PE}}}{P\,Y}\right) - \left(\frac{\overline{P_X Q_X^{G}}}{P}\right) - \left(\frac{\overline{P_X Q_X^{IPS}}}{P\,Y}\right) \right] -$$

$$- [\hat{\phi}_M] \left[\left(\frac{\overline{t_M P_M Q_M^{PRE}}}{P\,Y}\right) + \left(\frac{\overline{P_M Q_M^{PE}}}{P\,Y}\right) - \left(\frac{\overline{P_M Q_M^{G}}}{P\,Y}\right) - \left(\frac{\overline{P_M Q_M^{IPS}}}{P\,Y}\right) \right] +$$

$$+ [\pi] \left[\left(\frac{\overline{f(\tau, P, Y)}}{P\,Y}\right) - (1 - \alpha_p) + h \right] -$$

$$- [\hat{Q}_X^{PRE} - n] \left[\left(\frac{\overline{t_X P_X Q_X^{PRE}}}{P\,Y}\right) \right] - [\hat{Q}_M^{PRE} - n] \left[\left(\frac{\overline{t_M P_M Q_M^{PRE}}}{P\,Y}\right) \right] -$$

$$+ [\hat{Q}_N^{PRE} - n] \left[\left(\frac{\overline{t_N P_N Q_N^{PRE}}}{P\,Y}\right) \right] - [\hat{Q}_S^{PRE} - n] \left[\left(\frac{\overline{t_S P_S Q_S^{PRE}}}{P\,Y}\right) \right] -$$

$$- [\hat{Q}_X^{PE} - n] \left[\left(\frac{\overline{P_X Q_X^{PE}}}{P\,Y}\right)\right] - [\hat{Q}_M^{PE} - n] \left[\left(\frac{\overline{P_M Q_M^{PE}}}{P\,Y}\right)\right] -$$

$$- [\hat{Q}_N^{PE} - n] \left[\left(\frac{\overline{P_N Q_N^{PE}}}{P\,Y}\right)\right] - [\hat{Q}_S^{PE} - n] \left[\left(\frac{\overline{P_S Q_S^{PE}}}{P\,Y}\right)\right] -$$

$$- [\,n\,] \left[h + \left(\frac{\overline{W\,L^{PS}}}{P\,Y}\right) + \left(\frac{\overline{V}}{P\,Y}\right) + \left(\frac{\overline{SB}}{P\,Y}\right) - \left(\frac{\overline{SCPRB}}{P\,Y}\right) - \left(\frac{\overline{\Sigma SCPRE_j}}{P\,Y}\right) +\right.$$

$$\left. + \left(\frac{\overline{f\,(\tau,\,P,\,Y)}}{P\,Y}\right)(a_Y - 1)\right] + [\hat{L}^{PS}] \left[\left(\frac{\overline{W\,L^{PS}}}{P\,Y}\right)\right] + [\hat{Q}_X^{G} - n] \left[\left(\frac{\overline{P_X Q_X}}{P\,Y}\right)^{G}\right] +$$

$$+ [\hat{Q}_M^{G} - n] \left[\left(\frac{\overline{P_M Q_M^{G}}}{P\,Y}\right)\right] + [\hat{Q}_N^{G} - n] \left[\left(\frac{P_N Q_N^{G}}{P\,Y}\right)\right] + [\hat{Q}_S^{G} - n] \left[\left(\frac{P_S Q_S^{G}}{P\,Y}\right)\right] +$$

$$+ [\hat{Q}_X^{IPS} - n] \left[\left(\frac{\overline{P_X Q_X^{IPS}}}{P\,Y}\right)\right] + [\hat{Q}_M^{IPS} - n] \left[\left(\frac{\overline{P_M Q_M^{IPS}}}{P\,Y}\right)\right] +$$

$$+ [\hat{Q}_N^{IPS} - n] \left[\left(\frac{\overline{P_N Q_N^{IPS}}}{P\,Y}\right)\right] + [\hat{V} - \pi] \left[\left(\frac{\overline{V}}{P\,Y}\right)\right] +$$

$$+ [\hat{SB} - \pi] \left[\left(\frac{\overline{SB}}{P\,Y}\right)\right] - [\Delta\tau] \left[\left(\frac{\overline{f(\tau,\,Y,\,\pi)}}{P\,Y}\right)\frac{a\tau}{\tau}\right] -$$

$$- [\hat{SCPRB} - \pi] \left[\left(\frac{\overline{SCPRB}}{P\,Y}\right)\right] - [\hat{\Sigma SCPREj} - \pi] \left[\left(\frac{\overline{\Sigma CPSREj}}{P\,Y}\right)\right] -$$

$$- [\hat{t}_X] \left[\left(\frac{\overline{t_X P_X Q_X^{PRE}}}{P\,Y}\right)\right] - [\hat{t}_M] \left[\left(\frac{\overline{t_M P_M Q_M^{PRE}}}{P\,Y}\right)\right] - [\hat{t}_N] \left[\left(\frac{\overline{t_N P_N Q_N^{PRE}}}{P\,Y}\right)\right] -$$

$$- [\hat{t}_S] \left[\left(\frac{\overline{t_S P_S Q_S^{PRE}}}{P\,Y}\right)\right] + \left[\left(\frac{\overline{W\,L^{PS}}}{P\,Y}\right) + \Sigma \left(\frac{\overline{P_j Q_j^G}}{P\,Y}\right) + \left(\frac{\overline{V}}{P\,Y}\right) + \left(\frac{\overline{S\,B}}{P\,Y}\right) -\right.$$

$$- \left(\frac{\overline{f(\tau, Y, \pi)}}{P\,Y}\right) - \left(\frac{\overline{SCPRB}}{P\,Y}\right) - \left(\frac{\overline{\Sigma CPSRE}}{P\,Y}\right) - \Sigma \left(\frac{\overline{t_j P_j Q_j^{PRE}}}{P\,Y}\right) - \Sigma \left(\frac{\overline{P_j Q_j^{PE}}}{P\,Y}\right) +$$

$$\left. + \Sigma \left(\frac{\overline{P_j Q_j}^{IPS}}{P\,Y}\right)\right] + [r^* - n]\,[b^{PRS} + ol^{PRS} - oaps + den] + [r_B - r^*]\,[b^{FRS}]$$

$$+ [r_{ol} - r^*]\,[ol^{PRS}] - [r_{oaps} - r^*]\,[oaps]$$

The main differences between equations (35) (based on cashflows) and (D.4) (based on accruals) are:

(i) Equation (D.4) refers to the ratio between the public debt stock and output. Therefore it adds to eq. (25) all variations in the total debt/output ratio due to domestic inflation, output growth and, in the case of foreign debt, nominal devaluations.

(ii) In equation (25) the financial deficit is separated into the base period deficit and its current period increase. Here, however, the current period level of the financial deficit is maintained, although interest payments are divided into real interest rate and inflation components.

(iii) Therefore, equation (D.4) modifies equation (25) according to the impact of the following variables on the ratio between total public debt and output:

- real devaluation (which increases den),
- domestic inflation (which reduces h),
- domestic growth (which reduces h),

- the difference between the real foreign interest rate and domestic growth (which increases total public debt, net of monetary base), and
- the difference between the real domestic and foreign interest rates (which increases the domestic public debt net of monetary base).

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